APR 2 3 1988

594-C-49

FEM 1.209:550499

FLOOD INSURANCE STUDY

CITY OF MARION, WISCONSIN

WAUPACA COUNTY

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MAY 4, 1988

COMPLETED

Federal Emergency Management Agency

COMMUNITY NUMBER - 550499

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgments	1
1.3	Coordination	1
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	2
2.4	Flood Protection Measures	2
3.0	ENGINEERING METHODS	2
3.1	Hydrologic Analyses	4
3.2	Hydraulic Analyses	5
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	6
4.1	Floodplain Boundaries	6
4.2	Floodways	6
5.0	INSURANCE APPLICATION	7
6.0	FLOOD INSURANCE RATE MAP	8
7.0	OTHER STUDIES	8
8.0	LOCATION OF DATA	8
9.0	REFERENCES AND BIBLIOGRAPHY	9

TABLE OF CONTENTS (continued)

Page

FIGURES

Figure 1 - Vicinity Map 3

Figure 2 - Floodway Schematic 7

TABLES

Table 1 - Summary of Discharges 4

Table 2 - Summary of Elevations 5

EXHIBITS

Flood Profiles

North Branch Pigeon River Panel 01P 11

Flood Insurance Rate Map Index
Flood Insurance Rate Map

Elevation Reference Marks

FLOOD INSURANCE STUDY

CITY OF MARION,
WAUPACA COUNTY,
WISCONSIN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Marion, Waupaca County, Wisconsin, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Geological Survey (USGS) (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1823. This study was completed in May 1986.

1.3 Coordination

An initial coordination meeting was held in December 1984 between the Wisconsin Department of Natural Resources (WDNR), the Study Contractor, and FEMA. The meeting was held to define the scope of work for several communities in Wisconsin, including the City of Marion, and to obtain available flood information. FEMA later notified the City of Marion by letter as to the nature, scope, and purpose of the study.

On June 1, 1987, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Marion, Waupaca County, Wisconsin. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of the North Branch Pigeon River and Marion Pond was studied in detail.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through May 1991. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Marion.

2.2 Community Description

The City of Marion is located in northern Waupaca County and is bordered by the unincorporated areas of Waupaca County on the east, south, and west, and by the unincorporated areas of Shawano County on the north. It is situated approximately 50 miles west of the City of Green Bay, and approximately 40 miles southeast of the City of Wausau. The City of Marion is served by U.S. Highway 45, State Highway 110, and the Chicago and North Western railroad. The 1980 population of Marion was reported to be 1,348 (Reference 1).

2.3 Principal Flood Problems

Marion's flooding problems are due primarily to the overflow of the North Branch Pigeon River. The river flows from the west through Marion. In the event of a 100-year flood, the Marion Dam will be overtopped.

2.4 Flood Protection Measures

The flow of the North Branch Pigeon River in Marion is regulated by Marion Dam. However, it has been ascertained that Marion Dam may not protect the community from rare events such as the 100-year flood. The criteria used to evaluate protection against the 100-year flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for

floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Regional regression equations have been developed by Conger for estimating peak flows for floods on streams and rivers in Wisconsin. The Conger equation for central Wisconsin was used to estimate the 100-year peak discharge (Reference 2).

Peak discharge-drainage area relationships for the 100-year flood of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
NORTH BRANCH PIGEON RIVER		
at Main Street	19.3	560

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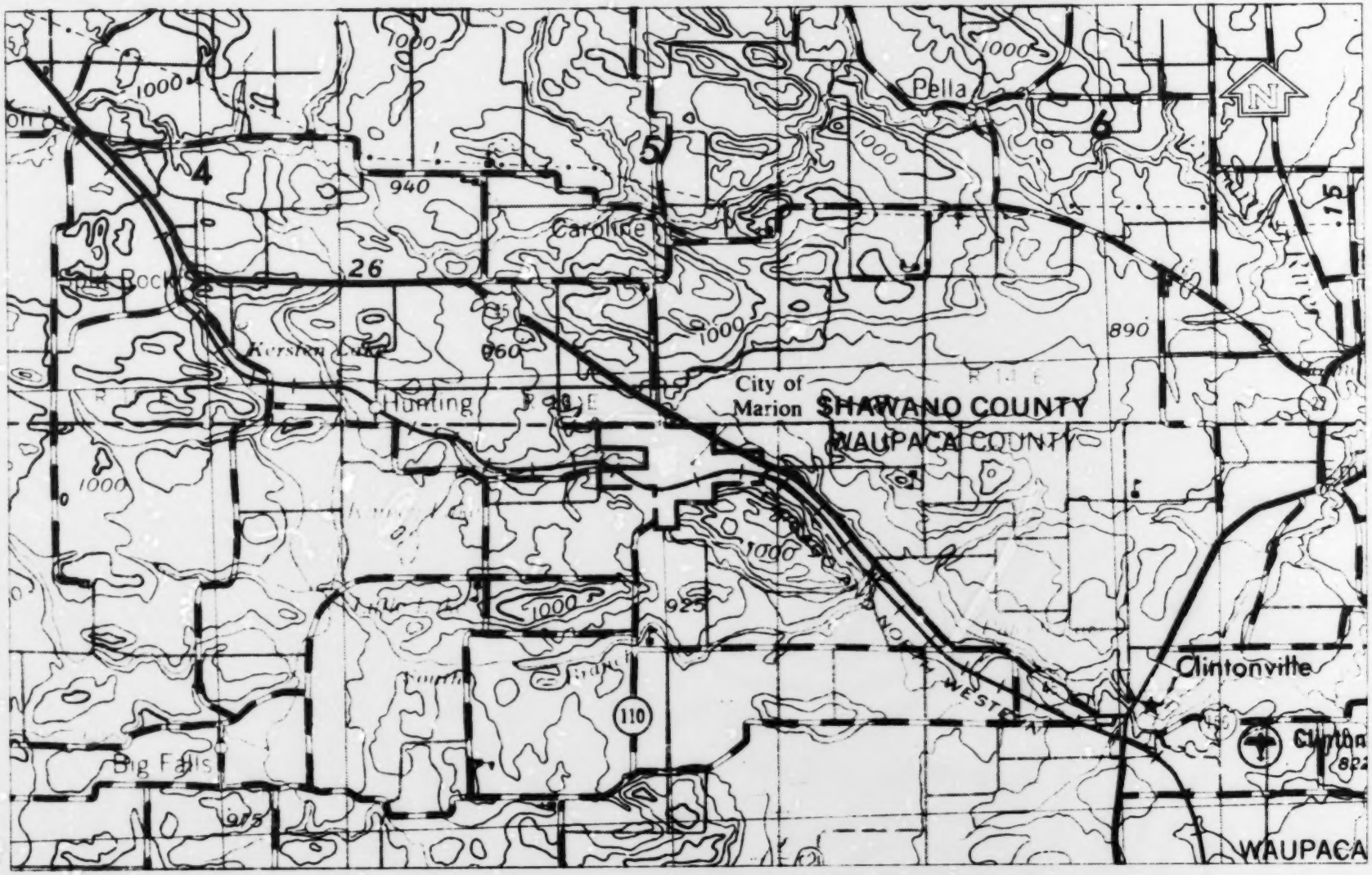

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MARION, WI
(WAUPACA CO.)

APPROXIMATE SCALE

2 0 2 4 6 MILES

VICINITY MAP

Elevations for floods of the selected recurrence intervals of Marion Pond are shown in Table 2.

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	PEAK ELEVATION (FEET NGVD) 100-YEAR
MARION POND	
entire shoreline	854

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the North Branch Pigeon River hydraulic analysis were obtained by combining information from field surveys of the channel and topographic maps (Reference 3). Elevations and structural geometry for structures were also obtained by field survey.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment based on field observations of the floodplain areas. The roughness values for the river channel and overbank areas ranged from 0.030 to 0.045.

Water-surface elevations for the 100-year flood were computed by WSPRO, a step-backwater computer program developed by the USGS for the Federal Highway Administration (Reference 4). The starting water-surface elevation for the section of the river downstream of Marion Dam was determined by the slope-conveyance method. The starting water-surface elevation at the dam is based on a discharge curve developed for the spillway.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. This study assumes four of the five gates of Marion Dam are blocked.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 3).

The 100-year floodplain boundary is shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Hazard Boundary Map for the City of Marion, Waupaca County, Wisconsin (Reference 5).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. However, the WDNR has established a policy that limits encroachment in the floodplain to 0.01 foot (Reference 6). The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of the natural conveyance of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than the State's allowable surcharge at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

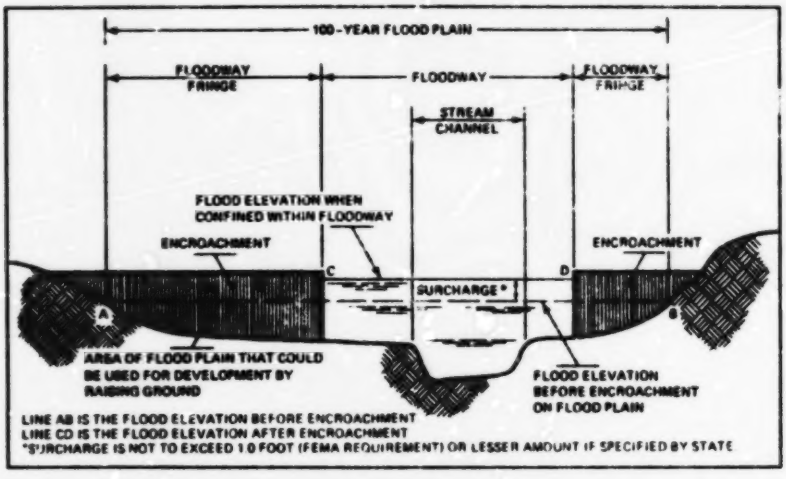
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

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Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

Flood Insurance Studies have been published for Waupaca and Shawano Counties, Wisconsin (References 7 and 8). This report is in agreement with those county studies.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the City of Marion (Reference 5).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

9.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Wisconsin, Washington, D.C., February 1982.

2. U.S. Department of the Interior, Geological Survey, Water-Resources Investigations Report 80-1214, Techniques for Estimating Magnitude and Frequency of Floods for Wisconsin Streams, D.H. Conger, 1981.

3. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Marion, Wisconsin, 1976; Clintonville North, Wisconsin, 1970.

4. U.S. Geological Survey, for the Federal Highway Administration, Office of Research and Development, FHWA/RD, Bridge Waterways Analysis Model/Research Report, J.O. Shearman and others, 1985.

5. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Marion, Waupaca County, Wisconsin, July 1976.

6. Wisconsin Department of Natural Resources, Wisconsin's Floodplain Management Program, Chapter NR 116, Register No. 362, 1986.

7. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Waupaca County, Unincorporated Areas, Wisconsin, February 1978.

8. Federal Emergency Management Agency, Flood Insurance Study, Shawano County, Unincorporated Areas, Wisconsin, November 1985.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0001	850.58	chiseled square on headwall of Marion Dam
2	0001	842.12	nail in light post on northwest end of northeast headwall of twin culverts for the North Branch Pigeon River under Parkview Avenue
3	0001	853.5	nail in base of light post located to the south of parking lot at east of Garfield Avenue

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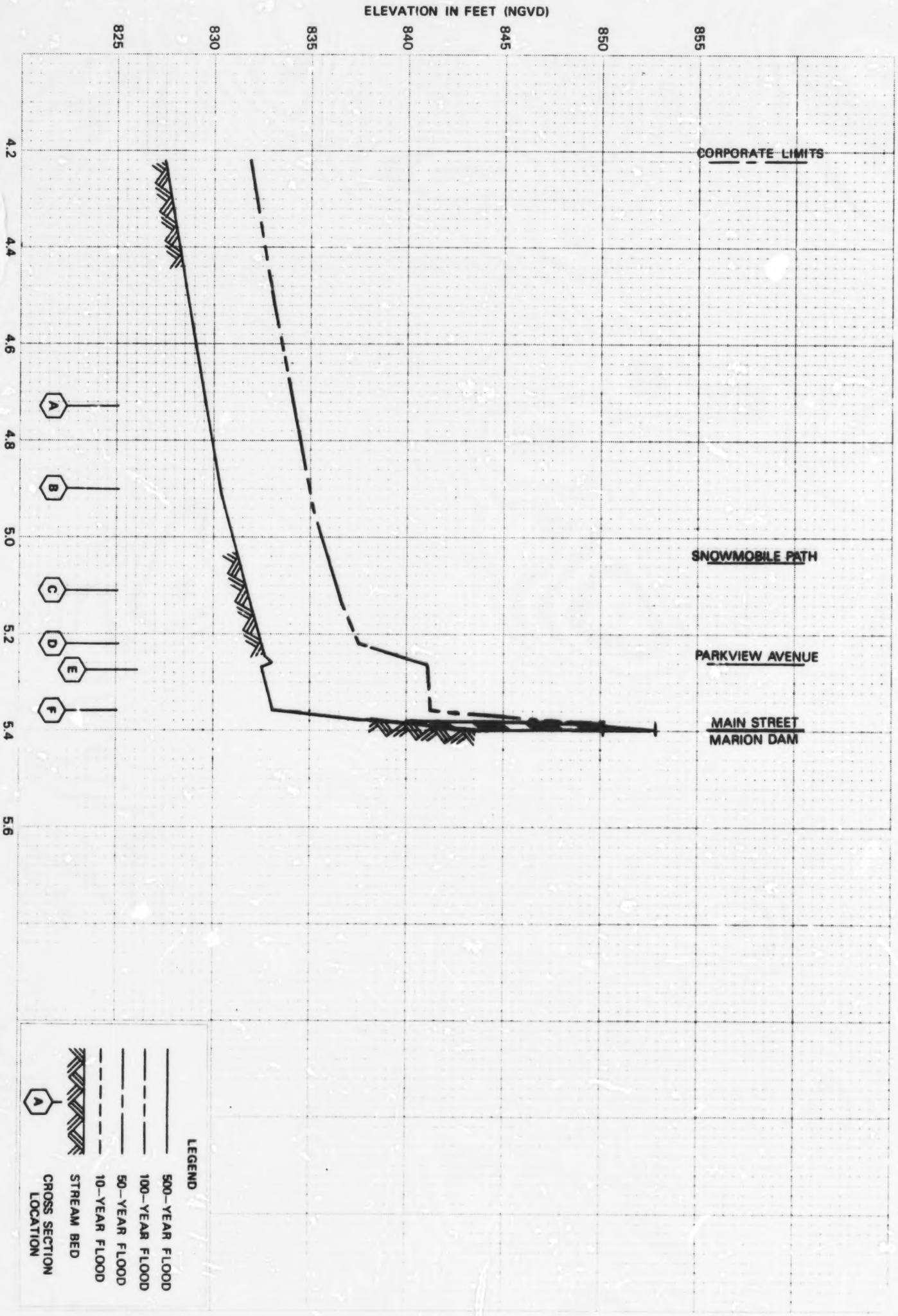

01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF MARION, WI** (WAUPACA CO.)	**FLOOD PROFILES** **NORTH BRANCH PIGEON RIVER**